HF Jet Tagging: DCA counting

Dennis V. Perepelitsa (UC Boulder)

Jin Huang(BNL)

Haiwang Yu (NMSU)

Outline

- I learned Dennis' BJetModule (extract tracks and Jets from DST to event level NTuple) and plotting macros (associate tracks to Jets, and analysis).

- 2nd-largest S_{DCA} bug in the plotting macro fixed.

- Used [Jin's Jet flavor tagging module](#) to tag HF jets from HardQCD:all instead of simulate HF Jet events separately using HardQCD:hardbb[cc]bar.

- Rejection vs. b-jet eff. and b-jet purity vs. b-jet eff. plot produced for MIE and MAPS+TPC. results consistent with / better than previous FastSim results.

Setup

Pythia 8:
- 200GeV p+p
- HardQCD:all = on
- PhaseSpace:pTHatMin = 30.0

Jet flavor tagging:
- Jin's TruthJet Flavor tagging module: analysis/HF-Jet/TruthGeneration
- Default cut: 25 < Jet pT <100 GeV, -0.6 < eta < 0.6
- Jet::get_property(prop_JetPartonFlavor)
- Jet::get_property(prop_JetHadronFlavor)
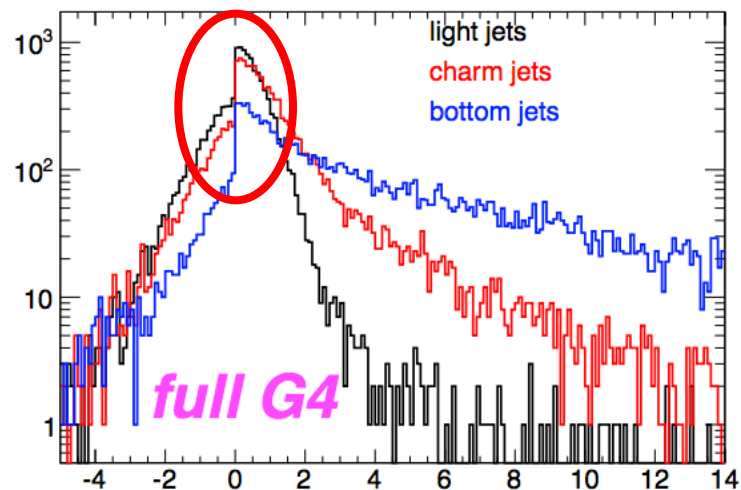
Track Reco:
- G4_Svtx.C
- G4_Svtx_maps+tpc.C

Jet Reco:
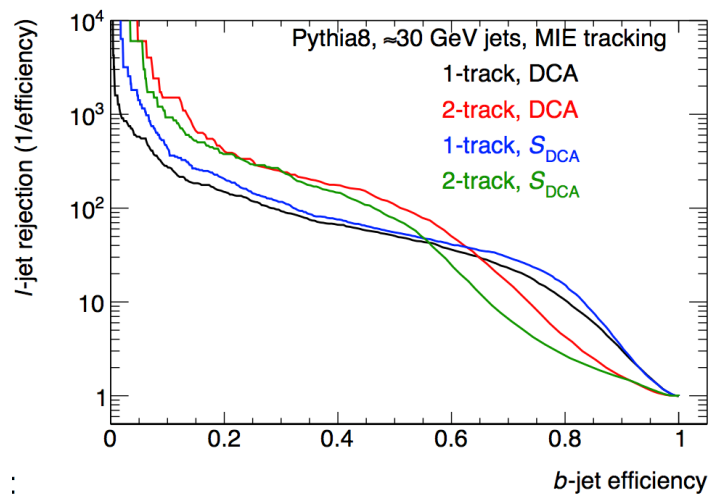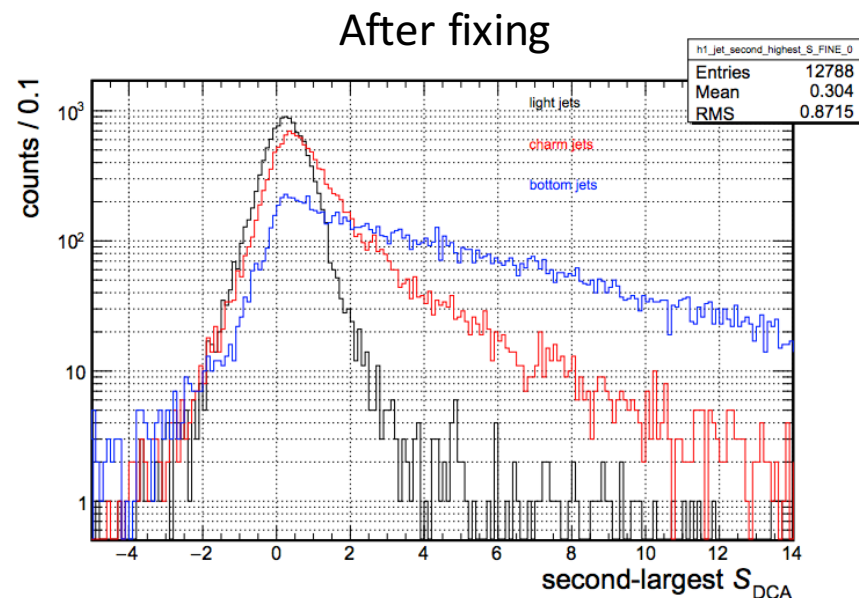- G4_Jets.C → JetReco::add_input(new TruthJetInput(Jet::PARTICLE));

Ana:
- AntiKt_Truth_r04
- 1, 2, 3 track DCA, S_DCA

A plotting bug fixed

Dennis' Talk in May.
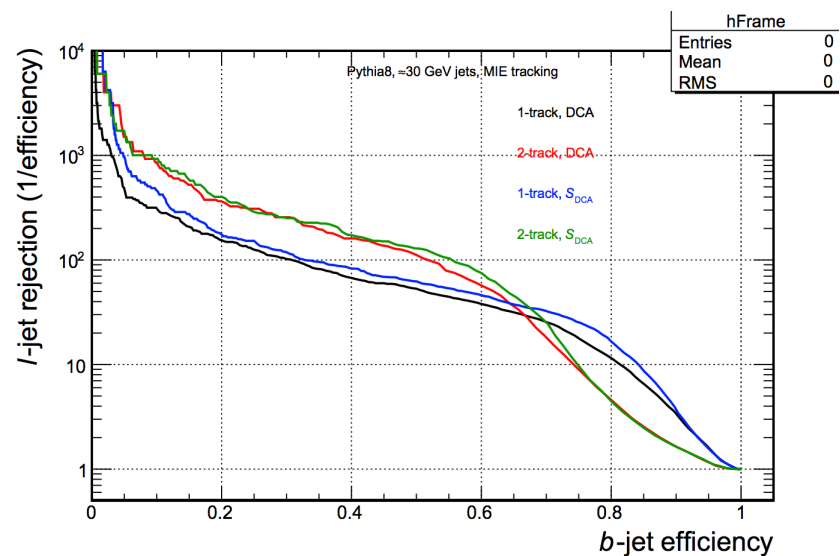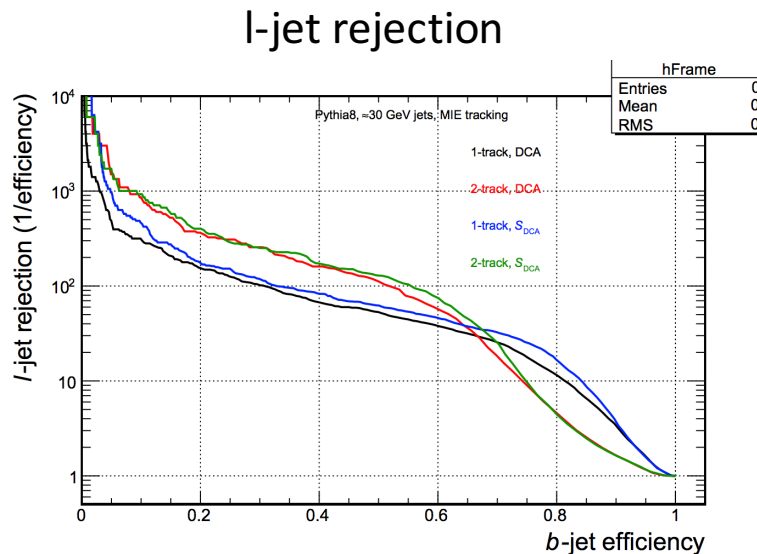
After fixing
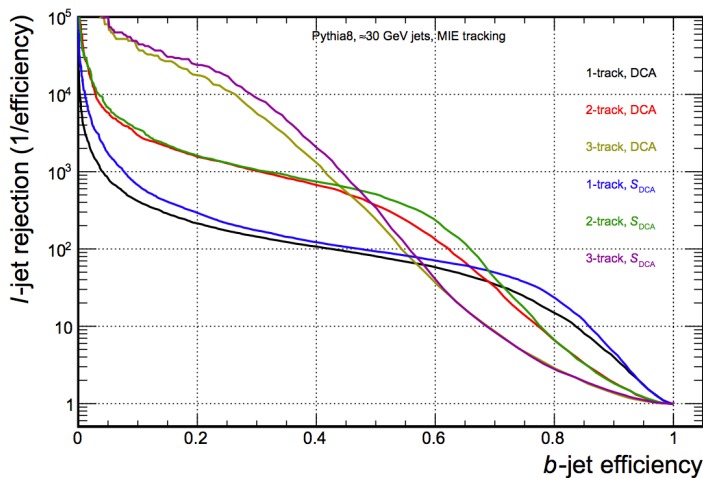
MIE, Parton Level Tagging
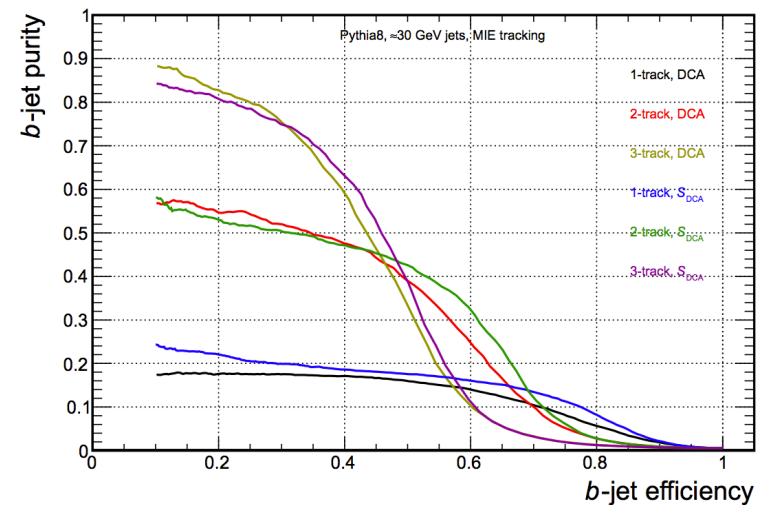
l-jet rejection

G4: Separate simulation

After using HF jets tagging from HardQCD:all instead of simulate HF Jet events separately using HardQCD:hardbbbar, the full G4 simulation rejection power raised to the level of previous FastSim results.

b-jet Purity

G4: Jin's flavor tagging
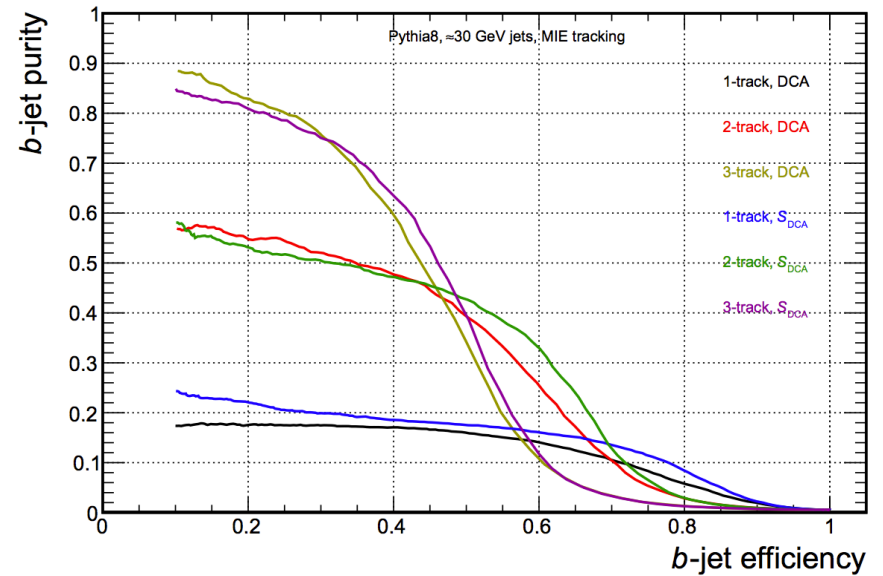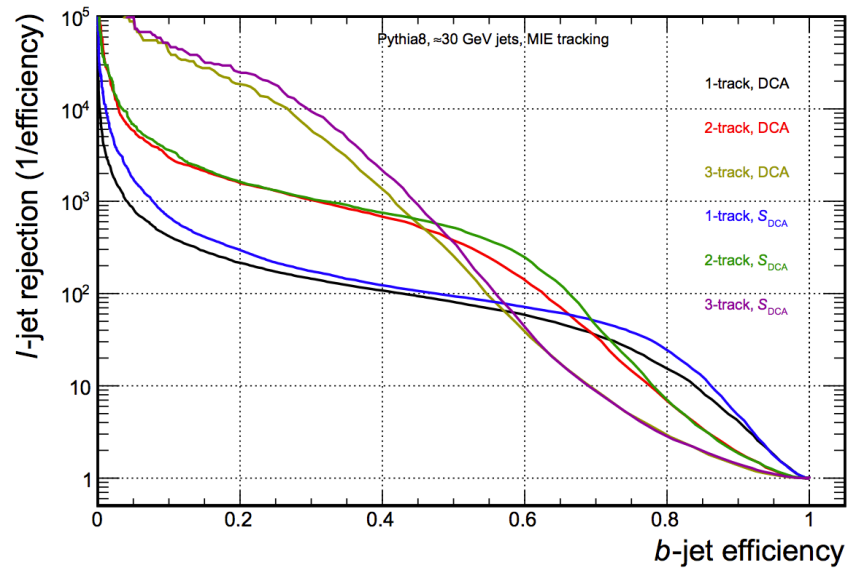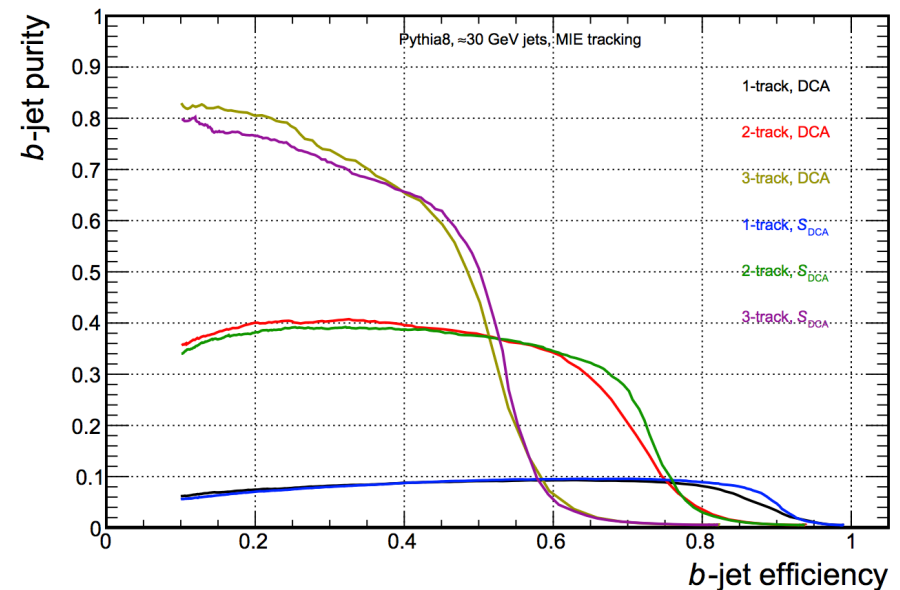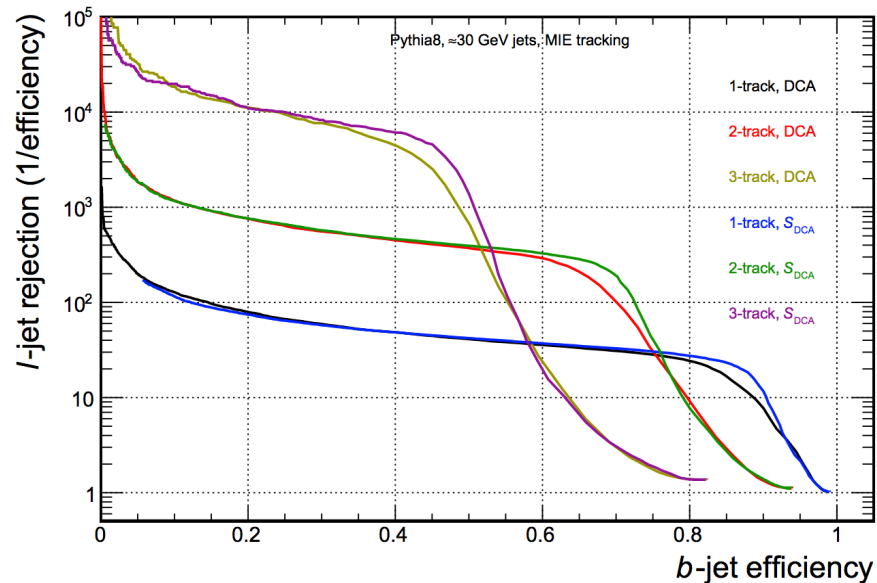
MIE, Hadron Level Tagging

The HF tagging performances are very similar between the parton level and hadron level jet truth tagging.

MAPS+TPC, Parton Level Flavor Tagging

- Similar plateau performance with MIE
- Raise to plateau faster / larger plateau
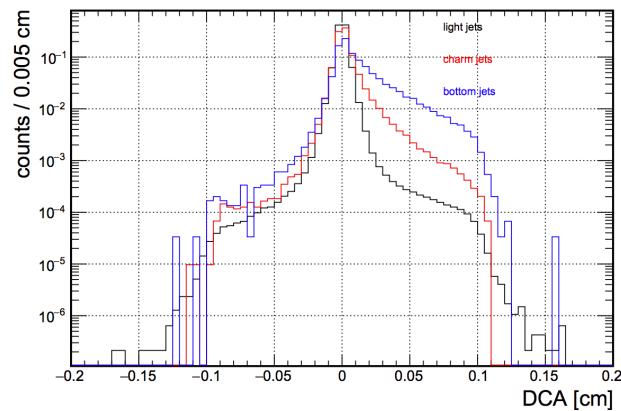

Time consumption running condor:
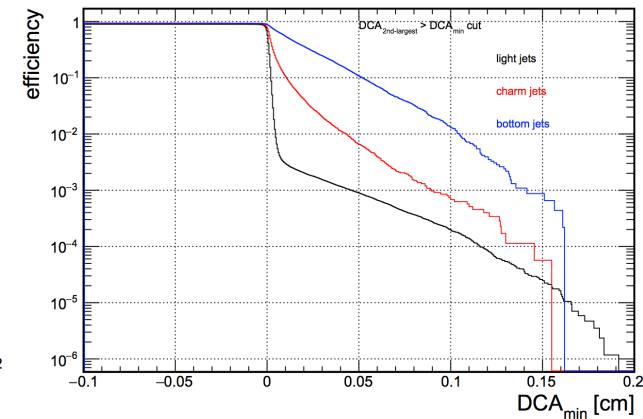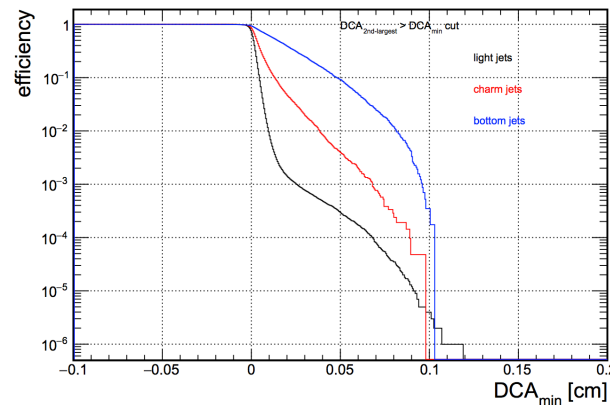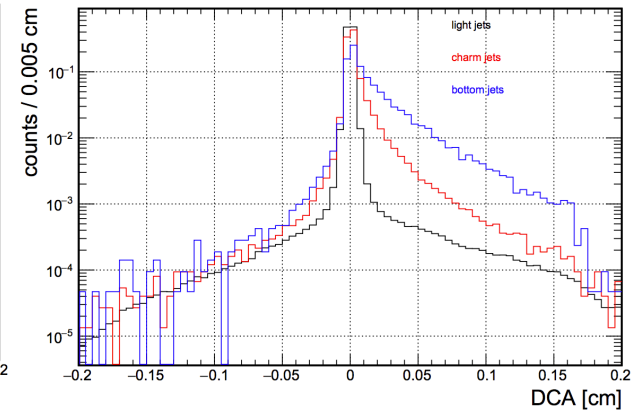- MIE 5000 events ~ 2h20min
- MAPS+TPC 5000 events ~ 6h - 8h

MIE

MAPS+TPC

Track DCA distribution

Efficiency:
2nd-largest DCA > DCAmin

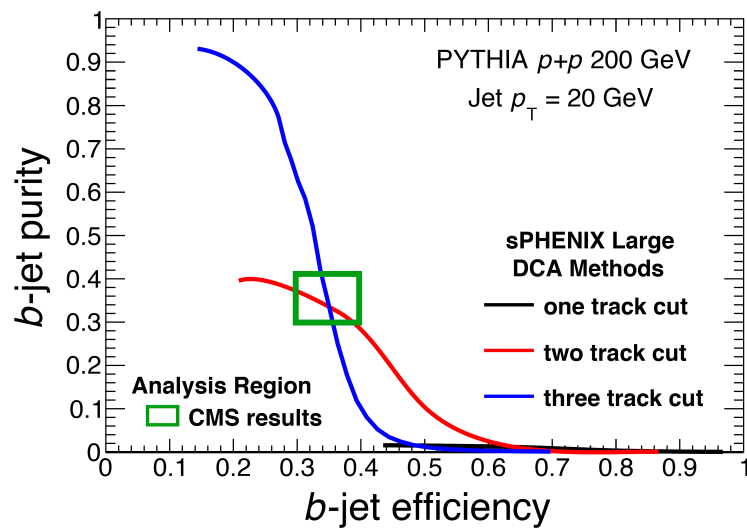MAPS+TPC has narrower DCA core for the l-jet

B-Jet Purity plots

G4: MAPS+TPC

sPHENIX Proposal
FastSim by Dennis

PYTHIA $p+p$ 200 GeV

Jet p_T = 20 GeV

sPHENIX Large DCA Methods

— **one track cut**

— **two track cut**

— **three track cut**

Analysis Region
☐ **CMS results**
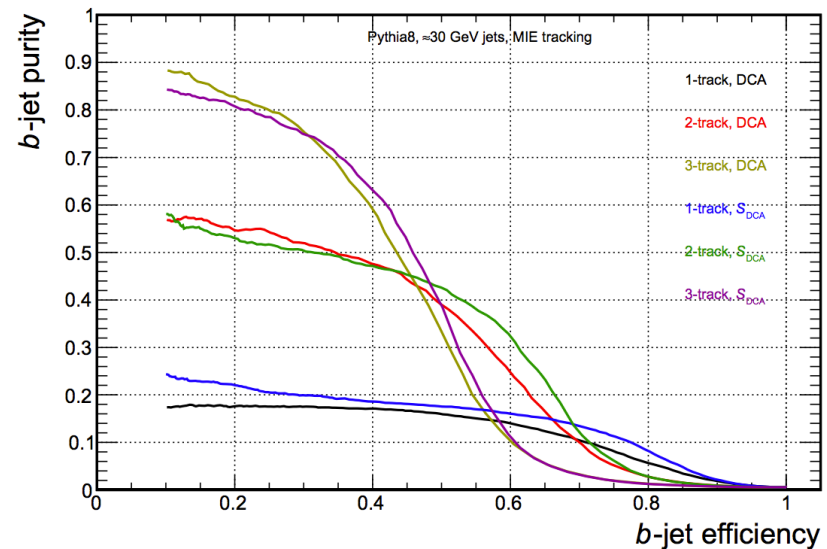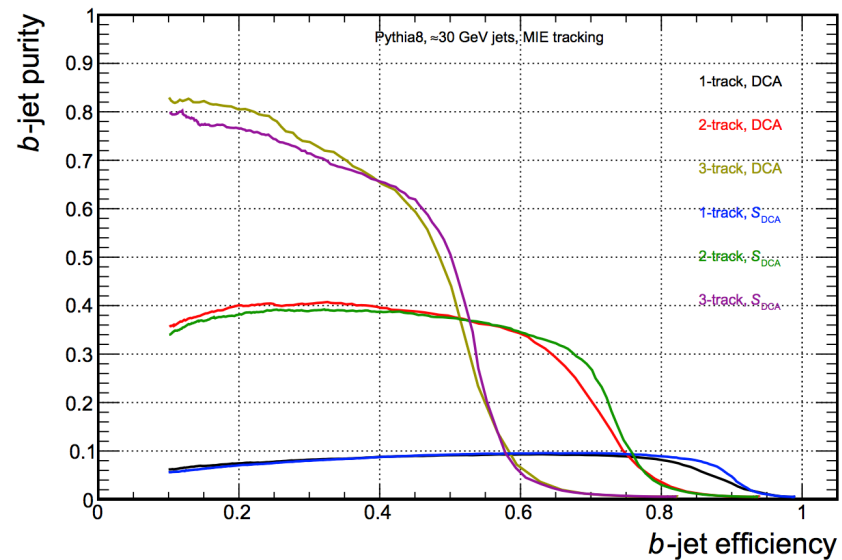
G4: MIE

Backups:

```
! Beam settings
Beams:idA = 2212     ! first beam, p = 2212, pbar = -2212
Beams:idB = 2212     ! second beam, p = 2212, pbar = -2212
Beams:eCM = 200.     ! CM energy of collision

! Settings related to output in init(), next() and stat()
Init:showChangedSettings = on
#Next:numberCount = 0              ! print message every n events
Next:numberShowInfo = 0              ! print event information n times
#Next:numberShowProcess = 1           ! print process record n times
#Next:numberShowEvent = 1             ! print event record n times

! PDF
#PDF:useLHAPDF = on
#PDF:LHAPDFset = CT10.LHgrid
#PDF:pSet = 7 ! CTEQ6L


! Process
#HardQCD:hardccbar = on
#HardQCD:hardbbbar = on
#HardQCD:all = on
#Charmonium:all = on
#SoftQCD:nonDiffractive = on

#PromptPhoton:qg2qgamma = on
#PromptPhoton:qqbar2ggamma = on
#PromptPhoton:gg2ggamma = on
#HardQCD:hardbbbar = on
HardQCD:all = on

! Cuts
PhaseSpace:pTHatMin = 30.0
```
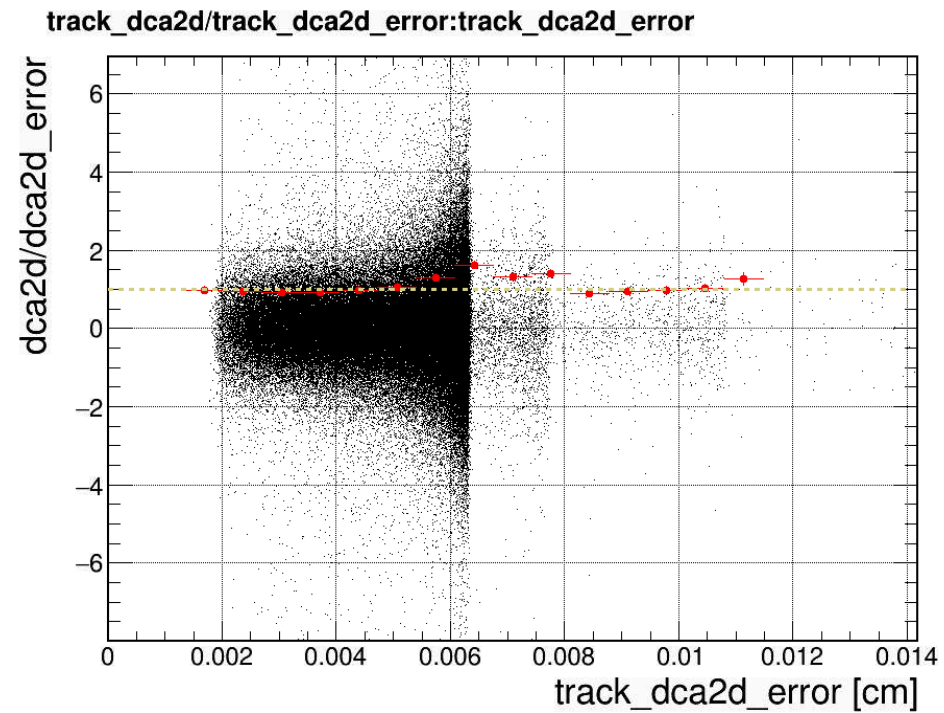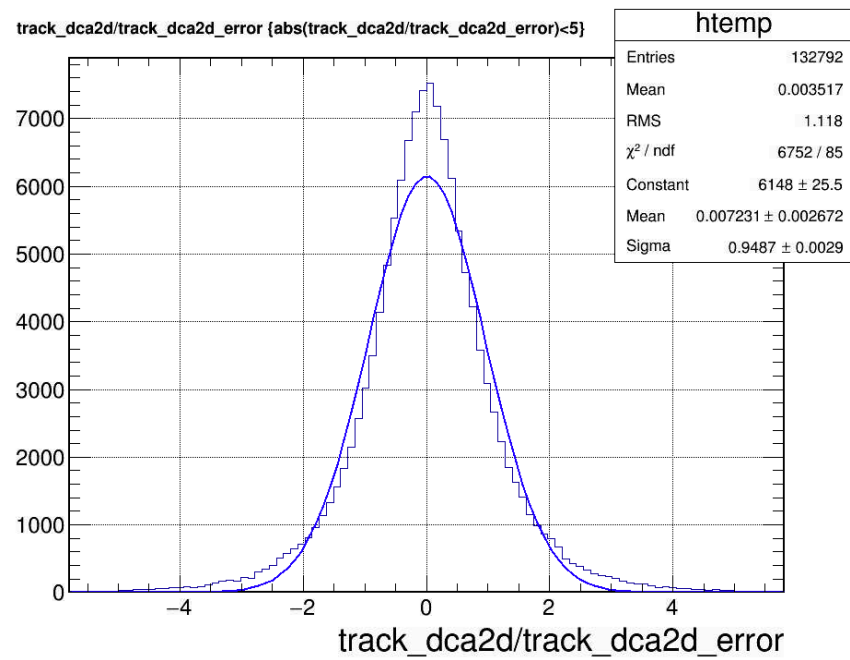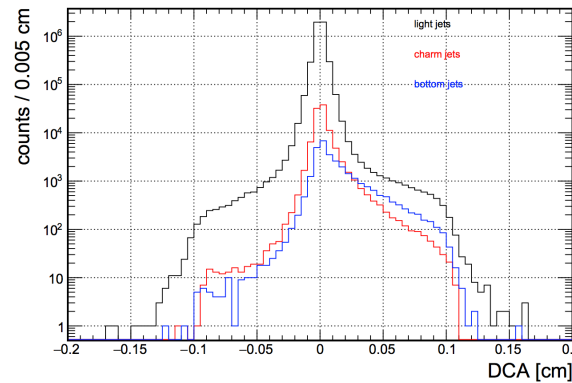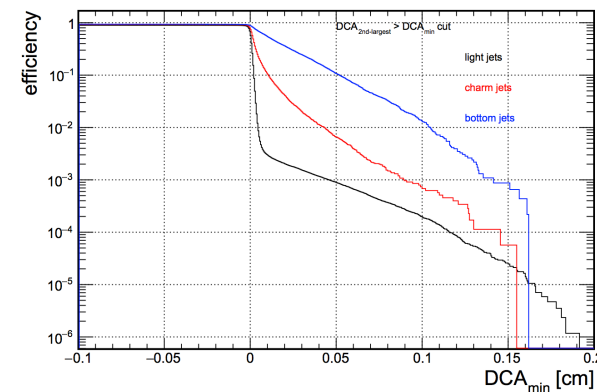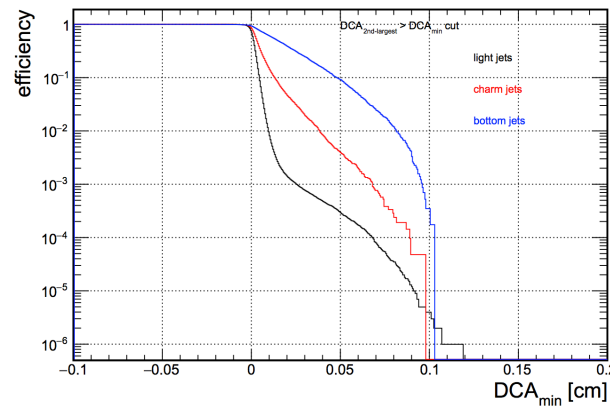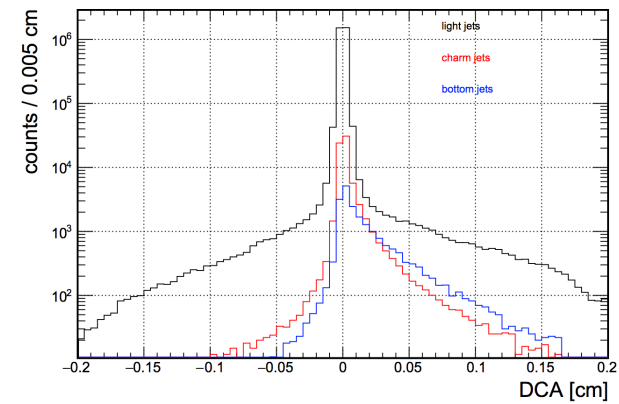
S_DCA vs. dca2d_error

track_dca2d/track_dca2d_error {abs(track_dca2d/track_dca2d_error)<5}

htemp	
Entries	132792
Mean	0.003517
RMS	1.118
χ² / ndf	6752 / 85
Constant	6148 ± 25.5
Mean	0.007231 ± 0.002672
Sigma	0.9487 ± 0.0029

track_dca2d/track_dca2d_error:track_dca2d_error

MIE

MAPS+TPC

Track DCA distribution

Efficiency:
2nd-largest DCA > DCAmin

MAPS+TPC has narrower DCA core for the l-jet